ORIOLA MUNEERAH OMOBOLAJI.

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PETROLEUM ENGINEERING.

ENG 281. Engineering Mathematics - I.

1- $P = \frac{E^2}{R}$

Given $E = 200$ volts. $R = 8$ ohms

$\delta E = -5$ volts $\delta R = 0.20$ ohms.

$P = f[E, R]$

$\delta P = \frac{\partial P}{\partial E} \cdot \delta E + \frac{\partial P}{\partial R} \cdot \delta R$

$\frac{\partial P}{\partial E} = \frac{2E}{R}$, $\frac{\partial P}{\partial R} = -E^2 R^{-2} = \frac{-E^2}{R^2}$

$\frac{\partial P}{\partial R} = \frac{-200^2}{8^2} = \frac{-40000}{64} = -625$

$\therefore \delta P = \frac{2E}{R} \times \delta E + \left[\frac{-E^2}{R^2} \times \delta R\right]$

$\delta P = \left[\frac{2 \times 200}{8} \times (-5)\right] + [-625 \times 0.2]$

$\delta P = [50 \times -5] + [-625 \times 0.2]$

$\therefore \delta P = -375$ Watts.

2. $y = \frac{kwd^4}{t^3}$

$\frac{\delta y}{\partial w} = \frac{kd^4}{t^3}$, $\frac{\partial y}{\partial d} = \frac{4kwd^3}{t^3}$, $\frac{\partial y}{\partial t} = \frac{-3kwd^4}{t^4}$

$\delta y = \frac{\partial y}{\partial w} \cdot \delta w + \frac{\partial y}{\partial d} \cdot \delta d + \frac{\partial y}{\partial t} \cdot \delta t$

$\delta y = \left[\frac{kd^4}{t^3} \times \frac{3w}{100}\right] + \left[\frac{4kwd^3}{t^3} \times \frac{2.5d}{100}\right] + \left[\frac{-3kwd^4}{t^4} \times \frac{4t}{100}\right]$

$\delta y = \left[\frac{kwd^4}{t^3} \times \frac{3}{100}\right] + \left[\frac{kwd^4}{t^3} \times \left[\frac{4 \times 2.5}{100}\right]\right] + \left[\frac{kwd^4}{t^3} \times \left[\frac{4 \times -3}{100}\right]\right]$

$\delta y = \frac{kwd^4}{t^3}\left[\frac{3}{100} + \frac{10}{100} + \frac{-12}{100}\right] \Rightarrow \delta y = \frac{kwd^4}{t^3}\left[\frac{3}{100} + \frac{10}{100} - \frac{12}{100}\right]$

$\delta y = \frac{kwd^4}{t^3}\left[\frac{1}{100}\right]$

where $y = \frac{kwd^4}{t^3}$

$\therefore \delta y = 1\%$ of y.